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Evolution of project management methods and implementation of new technologies in companies and start-ups to disrupt the markets

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Abstract

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<p>The subject of this thesis propounds to identify, to define and to explain why companies and / or startups change their project management. Indeed customer's needs and companies' call-offers are growing up sharply. This situation requires companies to react on their production management and services policies. As we will see recent transformations of the technologic and the web market conduct companies to redefine and improve their project management and technologies use.</p> <p>Qualitative research methodology was used in this research project. It consisted on four in-depth interviews from several web-technologies companies and startups.</p> <p>The results of the interviews revealed opposite point of views concerning different ways of using new technologies like cloud computing or open data. On the contrary, all respondents stated that they are currently using or implementing new projects management (lean and agile methodologies) in their processes. The results from these interviews show that this acceptance of new changes depends on both the company's size and the projects that are being created.</p> <p>The author recommends three main principles. The first one is to develop management projects around customer relationship like going through the agile methodologies. The second recommendation is to advise companies; despite the advent of new web revolutions, to invest later and meanwhile to take time to develop necessarily tools and frameworks in order to better perform when the market will be mature enough. On the other hand the last point would be to promote the creation of startups which will work on different projects linked to the evolution of the web. By disrupting or creating a new market, those startups would then interest big companies whom will buy them.</p> <p>Further researches could be led to put in form different types of relationships developed between companies and startups to create new markets.</p>	
Keywords	Agile methodologies, Lean Project Management, Cloud Computing, Open Data, Web 3.0, Frameworks, Startups.

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Introduction

Companies are changing and adapting to the evolutions of the world in terms of new processes of management, marketing, communication and use of new technologies. The question we are going to answer in this thesis is:

How do companies manage to implement new project management methods in their system and manage to combine them with the use of new technologies, especially the up-coming web 3.0, to disrupt the market?

A new way of conducting projects is developed and becomes more and more popular in companies: it is the Business Agility. Projects managers learn and implement more flexible ways to conduct a project from scratch to its final delivery. Business Agility is about this new scheme of management including more communication and feedback and the possibility of changing the initial plans to achieve the work asked by the customer in time, manufacturing the right product, the right way, at the right time.

In some start-ups process, agile methodologies are a component of the overall functioning of the entity called "Lean Start-ups". Those companies are implementing the benefits of agile methods to create more respectful products (by deleting wastes) and closer products to the vision of the customer.

Companies also turn to the "Cloud Computing" technology to ensure a quick transfer of information. The Cloud Computing is a service allowing a transfer of information from a server to another one online, or allowing the company to create a new server to have a new access to the company's data from everywhere.

The Cloud Computing is not to be confused with Open Data system. The Open Data allows companies but also public organisms such as councils to publish internal information to everyone. Then everyone can have free access to information (liberalization of information). Such information can be used to create or help the development of new IT projects and of start-ups.

All those new methods of project and people management has permitted the creation and development of the web 3.0 that brings a new capacity to respond

in real time to customers and stakeholders of the company (and also influences relations in workspaces).

IT start-ups are now combining all these new tools and methodologies to enter and disrupt the market to become what Eric Ries recently called the Lean Start-up.

Through the literature review we will define and explain all the theoretical terms linked to our subject of study. This will provide us the required knowledge to understand the point of views of the start-ups and companies that accepted to answer the questionnaire created for this thesis.

Chapter 1

LITERATURE REVIEW

This literature review explores new methodologies lately used by start-ups in the IT domain. These key elements of the thesis are the new management techniques and the possibilities of development brought by new online technologies.

Through this literature review the reader will become familiar with those methods and technologies. This section will provide the knowledge to start understanding the link between the elements that give to start-ups the possibility to disrupt the market by combining them.

1 IT Project Management Theories

The management guru Henri Fayol has defined management as the set of actions used “to forecast and to plan, to organise, to command, to co-ordinate and to control” (1949: 6). Management is applied to the supply chain, the production line, the employees etc. Through the decades of industrial development management processes raised, evolved and changed to better adapt itself to the market demand. The very first methods have been brought by Ford and Taylor in the automobile industry at the end of the 19th century.

Several types of project management exist and some of them are used by companies for many years. Those are commonly called “classic approaches” or “predictive methods”.

1.1 Predictive methods

Predictive methods are project management and software development methods using the principle of “planning by wave”. The tasks are based on sequential activities. These methodologies involve the planning of stages ahead of the project. They are characterized by a fierce attachment to every detail at the beginning of the project and thus lead that everything should be predictable.

The scheme of these methods is linear and a change of plan implies to review the entire process and to rehabilitate the continuation of the project according to the disruptive event.

Two famous models of project management exist. They are the waterfall (with the iterative waterfall that presents a supplementary characteristic) and the V-model.

1.1.1 The Waterfall Methodology

This methodology has been introduced and called this way by Dr. Winston W. Royce in his article "Managing the development of large software systems" (ed. TRW, 1970). As shown on the graph below, the model is simple to understand and to implement because it is logical in its development. In his article Royce presents the following diagram adapted for companies developing software systems.

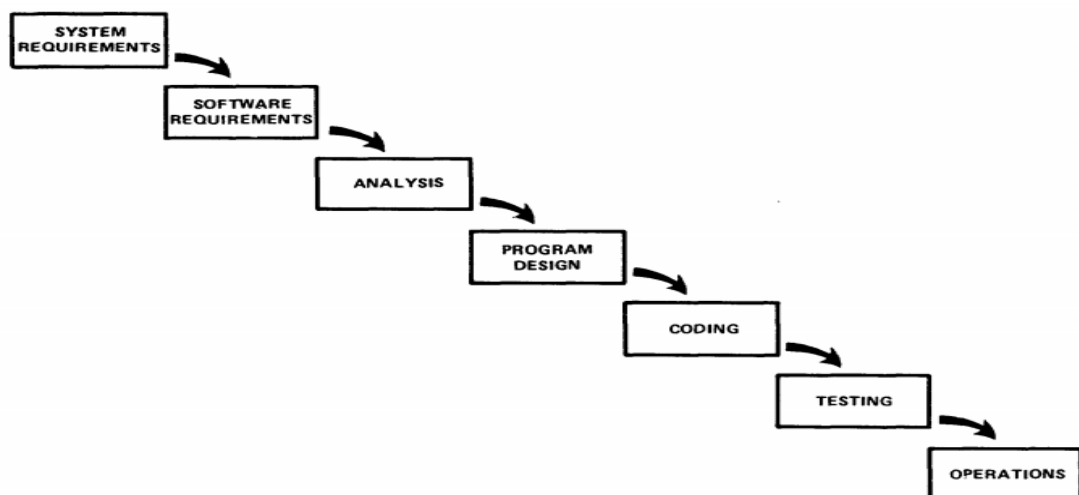


Figure 1. Implementation steps of the Waterfall model when applied to a software development process.

A waterfall project management plan describes how and when the work will be done in terms of planning, execution, follow-up and closure of the project without allowing any return to a previous step: the original plans must remain consistent. The steps are adapted to better solve the problems and move forward in the project within a minimum loss of time.

As Royce himself said in his article this model is not perfect because it is "risky" and do not allow to avoid "failure" (W. Royce, 1970: 2)

In "Software Modelling and Design", Hassan Gomaa (2011: 30) highlights two main disadvantages of the waterfall model in software development. The first point is linked to the "software requirements" step that often holds errors that are only discovered lately in the process because tests are not well developed at this early stage of the process. This correction then takes time and is costly. The second point is more general, referring to the problem detection in design and performance that are finding out only when the software becomes operational. At this time "it is usually too late to take effective action" (Gomaa, 2011: 30).

More the project advances in its creation more the detection of errors becomes critical.

Eric Ries in one of his conferences mentions the fact that waterfall model can't be used in the IT domain because of the fast development of the market and the new technologies. He indeed explains that many projects using Waterfall failed because specifications became obsolete during the production time, or because the customer wanted new specifications the product came late in the market. Ries points out the uncertainty environment that is the IT market to use the waterfall that by definition supposes to be very sure of the end product (Stanford University's Entrepreneurship Corner, 2009).

1.1.2 Back-Flow Waterfall Methodology

The Back-Flow Waterfall is very similar to the normal waterfall methodology but this one allows a certain possibility to return to the previous step in the process to correct some errors that may have occurred. Its limited advantage is that its new flexibility permits to move back and forth in the process without important changes in the schedule and the cost of the project.

1.1.3 V-Model Methodology

This model was created to solve the problems of the waterfall model described as not responsive enough by Pete McBreen in his article "Software Development: Dismantling the Waterfall" (Informit 2002). It is an improvement of the traditional waterfall model. The V-model certainly remained the most widely used life cycle for decades because it allows identifying and anticipating some early changing needs. When a step finds an anomaly, it reports directly to step "in front" of it in the model (see below graph).

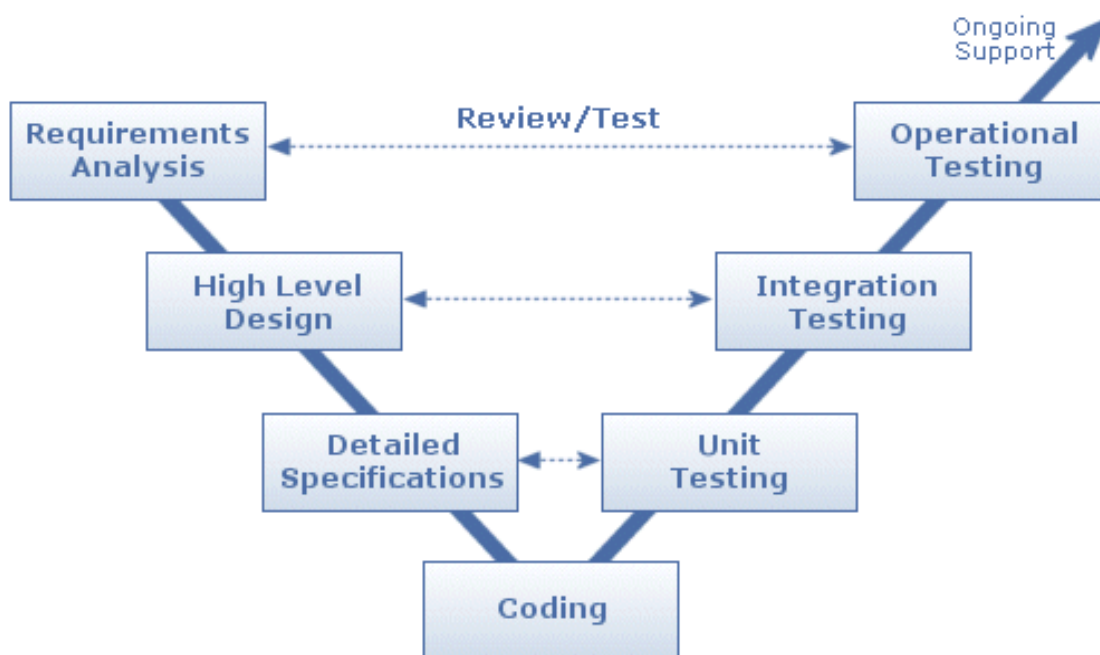


Figure 2. V-Model cycle process (Harmonic Software Systems)

With this model returns are possible and risks that the initial schedule no longer matches with the new features to implement is easily handled because this process works more like a circle.

Some other methodologies exist such as the B-model, introduced by Birrell and Ould in their book "A Practical Handbook for Software Development" to respond to the V-model lack in maintenance (1985: 71). Then the Rapid Application Development (RAD) cycle was defined in "Rapid Application Development" by James Martin in 1991. This last methodology represents a rupture with the predictive methods and it is a premise of another king of methodologies called "Agile Methodologies".

1.2 Agile Methodologies

In a fast moving environment and on the observations that initial plans often are modified and that requirements are constantly evolving to meet the market's new ones, predictive approaches proved to be too rigid and exposed organizations to too little reactivity.

This is why in recent years companies have created new methods of management: less predictive and more responsive to the needs of adaptation, facilitating agility of organizations. These are agile methodologies.

Among these methods is found in the first place the RAD one introduced by James Martin. The evolution of the methodologies led to two recently born and very used methodologies that are the XP Extreme Programming method explained in "Extreme Programming Explained" published in 1999 by Kent Beck and the Scrum methodology first officially described by Ken Schwaber and Mike Beedle in the work "Agile Software Development With Scrum" in 2001.

Agile methodologies are based on companies' needs to have a specific process allowing them to bring in the creation the customer and its needs. This involvement must occur before the product is launched to ensure that it responds to the needs. This essential and basic idea of the agile methodologies conception is explained and developed in "The Four Steps to the Epiphany Successful Strategies for Products that Win" by Steven G. Blank (2006: 4).

In 1994 the Standish Group International led a study about traditional software development projects. The results have shown that 31% of the IT projects were stopped before their completion, 51% were finished but with a delay on the initial schedule and a higher price of production. Only 16% of the projects could have been considered as real success. These figures are very low. The same study done 15 years later (2009, CHAOS Summary Report) shows a result of 38% of success. This number is better but still stays quite low. The main reasons for these failures were the lack of final users' implication (12.8%) and the changes in the product specifications during the production period (11.2%).

Those results highlight the need for start-ups to use new software and project management methodologies.

1.2.1 Operating principle of agile methodologies

The agile methodologies take the opposite view on the so-called traditional methods defined previously. They propose to involve the customer throughout the project with total visibility and a good communication from both parties, from start to end.

Agile methodologies are used to avoid unproductivity due to specification and planning before the start of the project. It plans and prioritizes steps advancements in a short time.

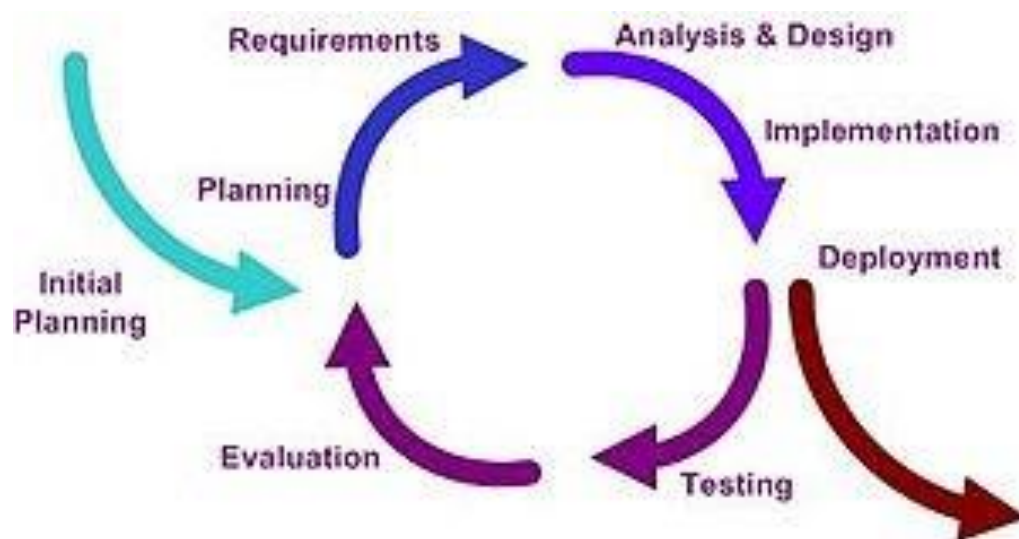


Figure 3. Agile methodologies principle on continuous feedback and improvement loop

This new managerial method is based on the cut of the final project in sub-parts or features called iterations. Doing so allows seeing in real time the project's progress and discerning if the functionalities respond to the needs of the clients. Those last ones will issue feedback to improve future iterations. A constant feedback becomes the rule.

Using the iterations allows the customer to receive a software with more features than originally planned. This method relies on a constant development and production rate. Changes or corrections are more easily integrated than in a project using a traditional managerial method.

The aim of this method is to increase productivity, to make minimize the documentation and to keep only an historical of the decisions to work more effectively on the project.

1.2.2 Agile methodologies process

A full detailed process of the agile methodologies has been created in Annexe 1 based on the notions learned during the researches done on books, the internet and the various graphs studied.

- The client provides some ideas to the development team (or User Stories).
- The product manager (or Product Owner) deals with the list of features and classifies them according to their priorities (production time and cost).

He is the central element of the AM scheme because he needs to keep a close relationship with both the customer and the team.

He updates the "Product Backlog" (a planning integrating all the "User Stories", in order of priority and duration in time).

- Daily meetings of the team are taking place to check the evolution of the project and find out obstacles and new iterations to work on.

The velocity of the development team is measured by the count of iterations delivered weekly; some are larger (in terms of time and price: they count for 2), others are smaller (they count for less than one and take less time: few hours).

The development of agile methodologies is quite recent. It already has allowed the development of new methodologies based on the agile feedback loop. One of this new management technics is the lean management.

2 Lean Management Theories

The term Lean Manufacturing has been introduced for the first time in the report "The machine that changed the world" by Womack & Jones in 1990.

Through the years the term has been developed and we now talk about lean management innovation, lean production, lean engineering and lean management. The idea behind this expression is to adopt a new way of managing production chains in various industries. Historically the first one was the automobile industry.

This management method is directly inspired from the Japanese's methods implemented at Toyota Production System (TPS) around 1950.

The lean management represents a new way for companies to handle their entire production chain. The main idea of this lean management and production is to offer to the customer what he is willing to pay for and nothing more. It is about finding the real value of a product by focusing only on the key figure a customer wishes to buy. It then excludes the excesses and wastes. It is about manufacturing with the real minimum of resources required to produce.

Those negative elements that impact the value of a product are ordered in three categories that are Muda, Mura, and Muri (according to their original Japanese names). They occur in nearly all the products' production chain.

2.1 The wastes that lean methods are developed to undo

The three types of waste are described by the Lean Enterprise Institute (2008: 61-63) as following.

2.1.1 Muda

The first type called "Muda" (that means "waste") is about the physical wastes that appear within the production line. They are seven different forms of wastes:

- Due to the overproduction: Producing too much is not good. The products created will require a stock placement. It is a loss of money and space.
- Due to the delay: if an employee is not working, or a machine not functioning, these two are producing nothing and then do not add any value. They are taking out time and money only.

- Due to transport: even if soon or later in the production chain there is a need to move the product, this transportation time is not adding any value to the product.
- Due to useless stocks: stocks are known to be money and place consuming, the less they are the better the company will be.
- In the production processes: Some operation may not be useful anymore but are still in the process because of habits or because an update has not been done.
- Movements: Movements of human beings are considered as wastes if they are not required for the creation of the product, it is a physical and energy loss.
- Due to defective parts: they can be repaired or may need to be replaced but in both cases they oblige supplementary actions that were not supposed to happen.

2.1.2 Muri

The Muri (overloading) is about the excessiveness of costs, workload of the employees, transports and also the unreasonable actions like asking for an important transport while only few elements need to be moved.

2.1.3 Mura

Mura refers to the variability of processes and resources that are not well managed. It implies that the overall effectiveness of the chain is impacted and slowed.

The Mura and the Muri are in most cases the reasons of the Muda. In the IT domain wastes are present and they are mainly linked to the energy consumption, the overload of employees and the time spent creating work pieces of the product.

2.2 Functioning and goals of lean methodologies

The implementation of lean methodologies and techniques in companies seem to be simple and logical but it is actually not an easy process. Five steps characterize the lean methods. They are detailed on the graph below:



Figure 4. The principle of lean methodologies (lean.org)

Step 1: To identify a value is about finding out what value the customer really seeks in the product.

Step 2: The mapping the Value Stream asks for identifying where the value is coming from in order to delete all the steps in the process that are not adding value to the end product.

Step 3: When the useless steps have been removed the company may add new production steps. Those will add value and also improve the effectiveness of the flow to have it as smoothly as possible.

Step 4: When the flow is launched it is up to the customer to make it run. This pull flow works efficiently thanks to the demand on the market. On the contrary a push system will imply to create more than the demand and so to have undesirable stocks.

Step 5: The goal of the lean methods is a vision that, because it is a vision, will never be reached. However it is this seek for perfection that makes the circle going on. Improvement is continuous. There are always new modifications and improvements that can be done to reduce again the wastes production.

The lean is a pull flow system, a just in time stream. Its main objective is to bring satisfaction to the customers and the employees of the company. The lean methods have a real capacity to improve a service production.

Three main criteria need to be reached to successfully implement lean methods in a company (R. Simonot, Lean Digestion):

1. A continuous improvement (*Kaisen in Japanese*) through a challenging process of questions from and by each member of the company. Learning continuously allows each employee to improve its work and himself in general. This point goes in pair with a respect of individuals through the security of the employment (cultural specification of the Japanese culture). The contribution of all is sought to allow a group working that will permit the introduction of new powers.
2. The second requirement is the instauration of managers that will manage the group and won't have any operational responsibilities (as it is the case nowadays). His role under this method is to guide his team, to fix ambitious objectives and to resolve any problem that the team can face to allow it to go ahead. He is an active animator of the team.
3. Finally the third criterion is the understanding of an overall vision that actively leads everyone's decisions. It is not necessarily realistic but it drives the entire company in this direction and this road to perfection.

The example of Toyota is the best when talking about lean methods and is used since its creation. The Toyota cars never had any problem because Toyota constantly corrects its past mistakes and delivers the products through a trustful production process. The standardization of all the elements is a key concept of the lean management.

The production system execution is simple but efficient and it gives a vision of operational excellence in the factories.

2.3 The Lean Start-up

The lean start-up is a very new concept directly coming from the lean methodologies of project management that are implemented and used in start-ups as soon as they are created. It impacts the overall creation and launches of new products in the markets.

2.3.1 Start-ups: concept definition

Before studying deeper this new concept we need to understand and define start-ups in general. In the common thought start-ups represent small companies, leaded by one or two employees that are entrepreneurs. This is however false because not all new companies are start-ups. Paul Graham defines in his website start-ups as being linked to the process of growth: "For a company to grow really big, it must make [(1)] something lots of people want, and [(2) something that] reach and serve all those people" (Paul Graham 2012). Start-ups get differentiated from other new companies by managing people and processes to answer those two requirements. Mr. Blank also defines it as a "temporary organization" that is created to "discover a profitable, scalable business model" (New York Times, April 24 2010).

2.3.2 Lean Start-up

The term Lean Start-up has been invented by Eric Ries in 2008 in his article "The Lean Start-up" published in September 2008. He uses this new term to refer to the new orientation that start-ups were taking. He has developed the idea in his book "The Lean Start-up" published in 2011. The definition made for lean start-up is quite simply but is in the meantime a little blurred. Its main aim is to develop start-ups capacities to make a quick development, to confront its environment with customers as soon as possible and to re-adapt according to the feedback received to start a new development (Ploki Info 2011)

According to this same article from Vianney Lecroart (2011) a lean start-up is using three trends that are: "the use of platforms enabled by open source and free software", agile methods (explained earlier on pages 11-14) and the "customer development" methodologies.

Lean start-up methodology offers the capacity to confront sooner with the customer, the market and the real world, and then to avoid losing time in longer processes from whom may result loss of time and money. This last point is pointed by Eric Ries on his website and his book through the following sentence: "My belief is that these lean start-ups will achieve dramatically lower development costs, faster time to market, and higher quality products in the years to come" (E. Ries 2008).

The entire lean start-up methodology relies on an everlasting "build-measure-learn feedback loop" (*The Lean Startup*).

This principle that allows starting created parts of the product is implemented thanks to agile methods as explained in the first part and through the annexe n°1.

The Customer Development Process (CDP) as defined on the online article "Why the Lean Start-up changes everything" (*Harvard Business Review*, S. Blank, 2013) is the central element of the Lean Start-up methodologies. As observed on the scheme below the customer is at the centre of the attention when developing the product. The project is based on his expectations, wishes and needs. During the first part called "SEARCH" the start-up will identify, understand and describe the customer needs until this one has validated it. On a second time the start-up will execute what has been planned previously by creating the product but always in keeping the customer very close so that the detection of errors will be quick and easily fixed. Involving the customer throughout the process will avoid a high risk of failure (*New-York Times* 2010).

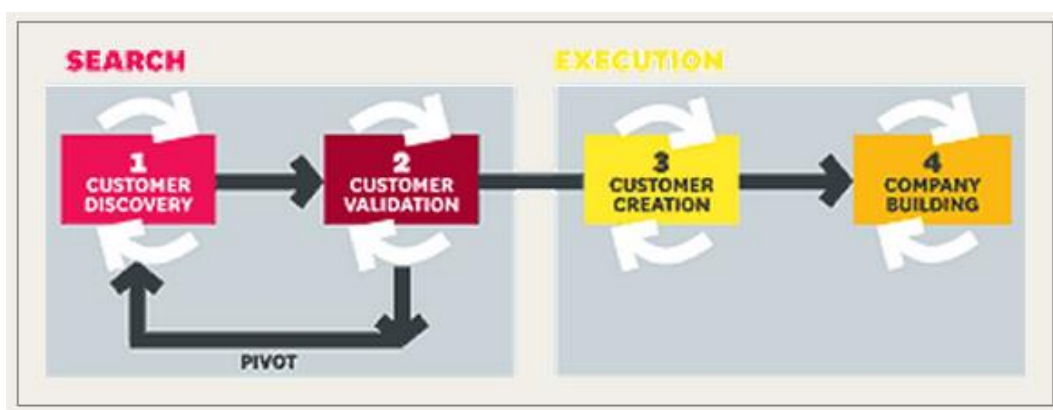


Figure 5. Customer Development Illustration (Harvard Business Review, May 2013)

It is now easier to understand the strong link between the Agile Methodologies and the Lean Start-ups processes. The Lean Start-up as we just have seen is fully based on the Agile Project Management Methodologies that involve the customer in the production, allow more flexibility, returns (circle process based on feedback) and reduce various types of wastes.

3 Web Development History

As the core purpose of this thesis is to understand how start-ups link new management methods with new elements of the web (Open Data and Cloud Computing) we first need to go through an overall presentation of the web.

3.1 Web 1.0: 1989 - 1999

The web 1.0 is the very first version of the Web. It has been created by Tim Berners-Lee, an English IT expert. He created the World Wide Web (usually simply called "web") in 1989 just after his integration to the CERN (the European Centre for Nuclear Research). His idea was to create a management system for information by sharing electronic documents, allowing the users to consult and create information (World Wide Web Foundation). The web 1.0 grouped the very first on-line pages that we could access from a computer.

Three elements characterize those websites:

- ❖ They were static. Data on the pages was only useful and purely to inform. It never changed from one day to another.
- ❖ Pages were not interactive. It was impossible for the user to contribute or to impact the websites (by posting comments or send messages to the administrator).
- ❖ Applications were proprietary. Under the web 1.0 companies developed software that users can download and use but they had no access to the functional system of the application.

A graph of the web 1.0 functioning is presented on annexe 2. It presents and explains the main steps that occur when a user was making a research on web 1.0 system.

Some software and protocols however existed at this time allowing users to correspond "interactively". However they were not a part of the web functioning because the available information was not interlinked with hypertext and URL (Uniform Resource Locator) such as the web do.

As an example of this we can mention Usenet (created in 1979) and Bulletin Board Systems. Both were very similar to the current forums online but were not connected to the web.

The web 1.0 connected the information and was oriented towards companies and institutions to give them an online visibility. It can be assimilated to a "push" system because it was distributing the information and the main ways of communication were the e-mails.

3.2 Web 2.0: 2000 - 2010

The term "web 2.0" has been used for the first time by Dale Dougherty in 2004 in a brainstorming conference session between O'Reilly and MediaLive International (O'Reilly 2004)

It is often defined by the numerous launches of interactive websites, highlighted with the boom of "blogs" (a personal online space where users can express themselves (Over Blog, "What is a blog?").

According to a recent study lead by the English society Netcraft (News Netcraft 2013), the number of websites was reaching nearly the 650 billion worldwide. This is 3.5 times more than in 2008. It means that during the last 5 years the number of websites created grown of 350%. When analysing this graph we can also see that the launch of blogs creation in 1999 (letter I in the graph here below) is the starting point of a new development of the web. In two years only the number of web-pages created has been multiplied by 4.4 (from 7.37 to 32.4 million, proportionally the biggest growth in two years' time in the history of the web).

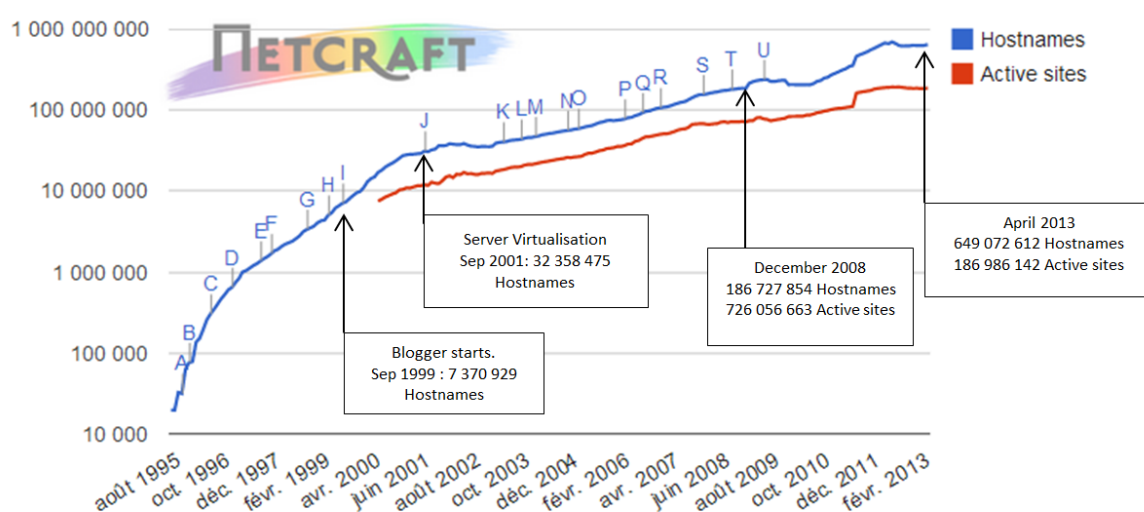


Figure 6. Total number of websites in the world (logarithmic scale) (News Netcraft)

A host-name is the name that is attributed to a website. Over time some of them are not used anymore but a host-name is unique and cannot be reused. This is why there is a difference between the number of host-names (website created) and the actual number of active websites.

This remarkable growth is linked to the new possibility for users to have an impact on the content of the pages, to interact with others, to share information not only with few people previously selected (like when using emails), but with big communities thanks to the creation of:

- Social networks like MySpace, Facebook, LinkedIn etc.
- Blogs like Live Journal or Twitter, My Blog Log, Word Press etc.
- Sites allowing users to contribute like the forums.
- Sites that let users share content, like YouTube or Drop Box.

This version of the web pushed-up the creation of communities through forums and social networks. In his article "What is the web 2.0?" (O'Reilly 2005) O'Reilly presents the main differences between web 1.0 and web 2.0. Those differences are about software's evolutions by the replacement of the old ones (like Flickr replacing Ofoto) and the new participation of the users (like in blogs).

Thanks to this new evolution lot of e-business companies and selling platforms (eBay, Amazon, Price Minister etc.) have been created, selling products online. Physical goods, music, e-books etc. can now be purchased from sellers that are on the other side of the world.

The web 2.0 also allowed the growth of digital financial flux all around the planet. It pushed companies to adapt to it in order to have more online visibility and to face competition. Companies did understand the importance to have an online presence by creating new strategies to invest this digital place through digital campaigns.

3.3 Web 2.5: 2010 - current days

The term web 2.5 does not officially exist in the history of the web but we can imagine it here to describe the current period of transition in which we are.

In ten years (from 2003 to 2013) the web has changed massively. More than blogs and social networks, lot of software appeared. However since a few years we can observe the advent of applications more than software. This evolution is

one characteristic of this transition period from the web 2.0 to the web 3.0. The development of the Open Data and of the Cloud Computing are only few years-old. These two new technologies are new features we have just discovered and started to implement in our lives.

The web 2.0 (including 2.5) is the "social web" (c-marketing, "web 2.0 definition"). It is a tool that we would hardly be able to live without. The evolutions are made for and by the society (companies and users) to make it always easier to use, more efficient and relevant to answer the new needs and expectations.

3.4 DropBox: the IT start-up that disrupted the market

Web is the new place to start businesses. Because Internet is used by more people and is asked to answer new needs every day, this technology is a powerful source of opportunities for new companies to be created.

A famous example of a start-up that achieves to create an entire new market based on the needs created by the web 2.0 is DropBox. The start-up has been created from this period of digital growth (since 2000). As Victoria Barrett explains in her article (Forbes, Magazine Cover, Nov. 7th 2011) Drew Houston created the DropBox to answer the limitation of data storage that users were facing more and more often when using Internet. With the development of smartphones and tablets, users wanted to have their data available on all their devices. Sharing of data by sending e-mails (problems when having heavy files) or by using USB key (not possible to share data with people working far away) was not efficient anymore.

His solution was to create this tool that is a premise of the Cloud. It was a new technology that completely changed the attitude of users in their utilization of the Web.

The start-up actually rose \$240 million in 2011 and more than 50 million users in just 7 years of life. DropBox had a very great launch and is a very good example of a start-up that managed to disrupt the market of IT (big creating a new market of online storage).

The company now has to expand and get developed. Its major problem is to get sustainable on the long run. Over services indeed popped-up to compete with it, like SkyDrive, Google Drive, Sugar Sync etc.

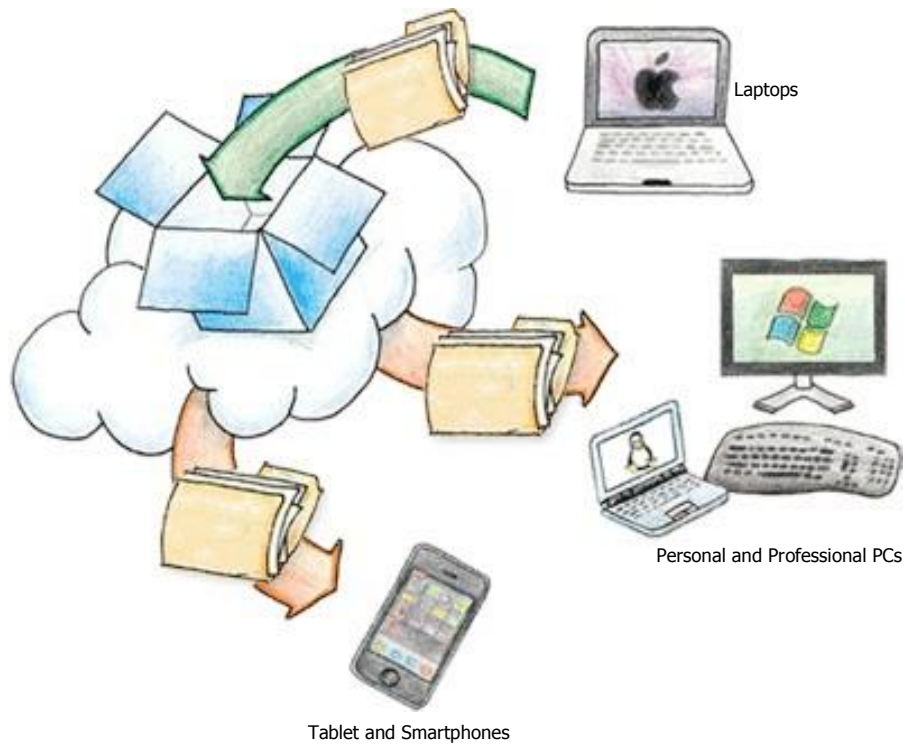


Figure 7. DropBox technology and services representation

4 Cloud Computing System

4.1 Basic definition of Cloud Computing

The Cloud is a meta-computing virtualization system. Cloud Computing or simply Cloud as seen in the example in the previous part has been created with the launch of the DropBox and the iCloud presented by Jobs (Zdnet 2011)

According to National Institute of Standards and Technology (NIST) of the American federal government, Cloud Computing is:

"a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" (NIST Special Publication 800-145, 2011: 2).

This system can more commonly be defined as an online and virtual server used to store data (Futura Sciences "Cloud Computing"). The storage can be free (like Drop Box under 2 Go of storage) or not. Some Clouds are public (for every users) others can be private (like an internal Cloud in a company).

4.2 The Major Features of the Cloud Computing

In its report the NIST (NIST Special Publication 800-145, 2011) highlights several key characteristics of cloud services including:

- The resources elasticity
New capabilities of storage can be automatically made available to users if they need an increase of storage space. This elasticity creates the illusion of infinite capacity that can be offered at any time.
- Easy access via the network
Cloud services are available via a network, whether from the corporate network (to an internal cloud) or from Internet to an external cloud. This access is performed using mechanisms that allow the use of cloud services from multiple types of terminals, as shown on the graph below.

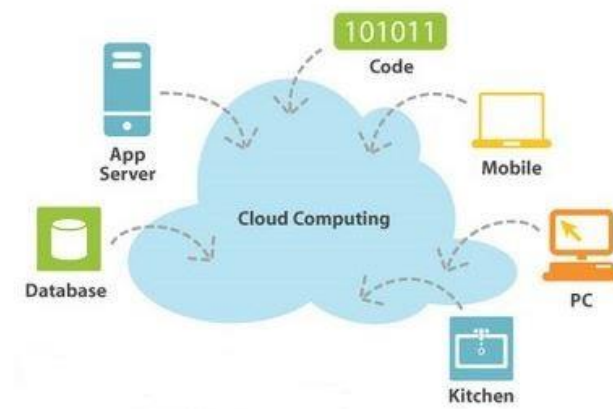


Figure 8. Representation of the environment systems operating with Cloud Computing

➤ Controlled costs through the pooling of resources

Cloud's resources are pooled and shared to serve multiple users. Through the pooling of resources, free spaces are reallocated dynamically based on demand without forcing the user to perform any operation whatsoever.

This sharing also presents economic benefits because the same storage capacities that are not used in one continent (because of the night) can be used on the other side of the world (because it's the day). Then the functionalities of the Cloud are always used.

➤ Better agility of Information Systems (IS)

The user of the service can quickly have at his disposal the resources needed (storage, applications etc.) without having to go through lengthy and manual configuration steps. This capability allows the IS to respond faster to the business needs like requests for various changes or to increase the on-time rate of responds to the market demands.

4.3 Components of the Cloud Computing

To use Cloud Computing a person needs a subject access (or device), which is most often a laptop, a tablet or a smartphone.

This device needs to be connected to a wireless networks such as the Wi-Fi, 3G or 4G, etc. The internet connexion is mandatory to get the access to a browser (Chrome, Firefox, Internet Explorer etc.). That will provide the user with an internet access to the universal network where he will be able to reach the online

server he wants (Private or Public Cloud). Applications that provide value to users will be available on these servers.

They are different types of Clouds:

- Single Sign On Services. The access object will give a connection to Sign On to services hosted on a public cloud. This Sign In process will ensure a secure access to all the services that the user needs to use.
- Public clouds are priority used for all general purposes SaaS (Software as a Service), such as:
 - Communication and collaboration platform (e.g.: Google Apps)
 - Intelligence and big database analysis (BIME, Big Query, etc.)
 - BPM: Business Process Modelling (e.g: RunMyProcess)
 - BPaaS (Business Process as a Service): hundreds of standard processes such as Amiando for managing events or for Concur Travel Management are available.
- Cloud communities are available in some activities such as transports (Amadeus) or finance (Visa) and host all shares business applications.
- Private Calculator Centres (or private clouds) where applications available are specifically developed and hosted for and by a company.

Today Cloud Computing represents a complex infrastructure and is a new tool that allows the implementation of the Semantic Web (web 3.0) both for individual as for professional use.

5 Open Data Development

The open data is a tool to make certain data available to everyone and to overcome the restrictions imposed by the licensing agreements sometimes implemented by the public or other forms of control such as modification or restriction (Actions Open Data, "L'Open Data"). The technology is fully entangled with the data it supports. Container and contents serve each other.

5.1 Open Data Approach

At first, the goal was to enforce greater transparency and improve the share of documents and the lives of citizens. It was a political initiative led by the US government in 1966 through the adoption of the law on the free access to information "Freedom of Information Act" (FOIA Gov, "About FoIA"). Then it has been extended worldwide.

As we can see on the representation below that summarizes the Open Data (in French), this tool allows to put in common data that previously were not shared with everyone (Citizens, Communities and Entrepreneurs). The interaction between those major actors is increased.

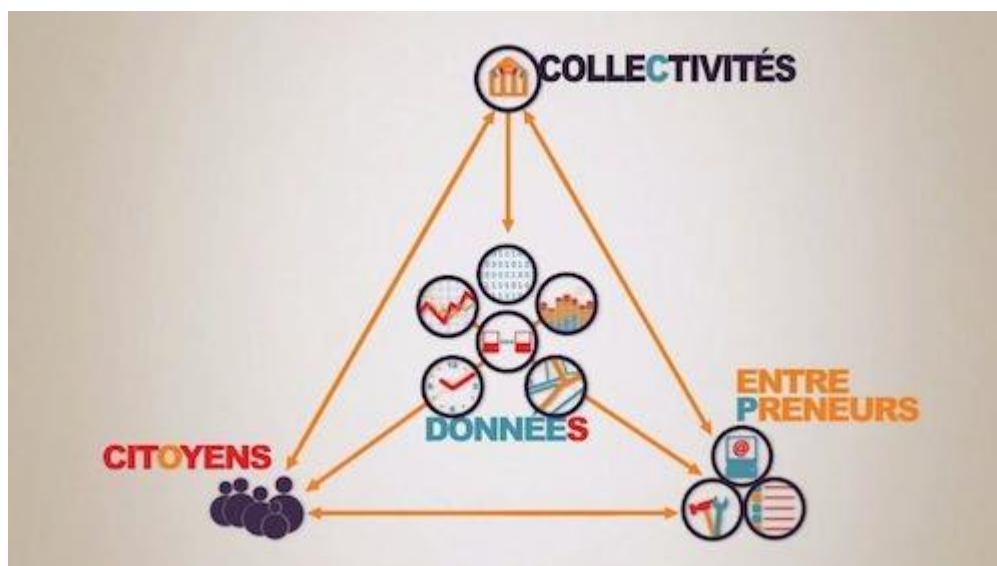


Figure 9. Simplified Representation of Open Data Interactions

Those data can serve citizens and journalists to find information, researchers to improve their work, IT developers to create new services and companies to create new services that will add value to the data (Action Open Data, "L'Open Data").

This interaction and the free use of the data represent an unprecedented development in the world of technology. It allows the development of new businesses based on innovation and free access to information.

All open data must be complete, raw, recent, accessible without discrimination, electronically readable by a machine, available in open formats, under a free license, on-line in a sustainable way (continuous time) and without operating costs.

An example of association created thanks to the Cloud is LiberTIC. It has been created to gather people with a common objective to create business from the Open Data available. It is an activist group that is promoting the use of Open Data. The website OpenData-Map has been created by this association of person.

5.2 The Public sector at the service of the Private

The advent of Open Data in the international digital landscape is considered as a revolution. It has been thought to evolve in a technological world that tends to move fast and based on the wave of smartphones uses to bring more transparency to the actions of public institutions. This system gave birth to a public-private partnership.

Most of the data available is coming from the public sector. Institutions are sharing not only to increase the transparency of their work but also to push the creation and the innovation around their data (a location-based project can be one of them). Private companies and start-ups are those who reuse data the most.

Thanks to the open data the budgetary barriers, that represent the right to use licenses and allow small businesses to grow, are lowered. Public institutions can enjoy the development of capabilities which were previously unexpected.

A summarizing visual of the Open Data history is provided on annexe 3 for further information on the worldwide growth and development on this system.

5.3 The birth of a new economic model

According to the European Commission "the European internet economy was 4.1% of EU GDP in 2010" (European Commission, SEC(2012) 680 2012: 2). The single publication of data is not a source of income. It is the creation of a society

or a concept that reuses data to offer a new service that will create a new business.

But the Open Data is not only developing the economics of the private sector, the public sector has indeed won a lot from these releases.

All public data are distributed on platforms which everyone can access. The French Government publish all public expenditures distributed and so each citizen can see where his "money is invested." The Open Data can therefore bear overspending or lack of performance of businesses.

The economic impact of digital data is difficult to assess. Benefits cannot be displayed because the approaches for the calculations are still under development. The field of Open Data is still too small to speak of a real digital economy so far.

5.4 Optimize the shares with crossing data

Exposing public data allows creative people to develop innovative tools. Nevertheless, the data provided are not always sufficient and it is therefore recurrent to have to interbreed data with others in order to achieve a rich and useful service.

The idea is to make search engines more interactive by having them first to clarify the research, and searching relevant information in dynamic data stored in the web space.

An example of this crossing can be the schedules of public transport. These data are available for anyone. One could use it to create an application in a given city. The application will provide full schedules for a selected bus, alert the user of a possible problem on a line, or the time remaining before the next passage at a given stop. The idea however is limited in terms of utility. Then if we decide to supplement these data with other open data as a mapping of sidewalks' height and width of the city, we could then create a tool to give the line-best route for wheelchair users wishing to travel by bus.

This crossing open data forms the "Linked Open Data".

Linked Data is defined as "a standard way to represent data on a wide range of topics. Publishing Linked Data makes it easier for developers to connect

information from different sources, resulting in new and innovative applications.”
(OpenData Europa)

The passage from the "Open Data" to the "Linked Open Data" is in process but is not easy. Several settings are performed on the data that we shared so they are easier to use. With cross-sectional data, we can browse and access the most relevant information in record time with guaranteed reliability.

The provision of Open Data allows passing the information accessibility to another level. Now that this evolution is running, the next step will be to unite the Open Data with promising infrastructures and technologies of the Cloud Computing and to enable a better management of breeding data.

The evolution of data management is the ethos of Web 3.0. In other words, the more the management of cross-tabulations will correctly work the more the future performance of web 3.0 applications will be developed, powerful and effective.

6 Disruption of the Market

6.1 Disrupting technology

A disruptive technology is the innovation of a product (or a service) that will take the place of another technology already implanted in the mainstream market and used to be the leader. This technology brings higher technological performances than the existing ones. It then replaces those old ones but do not create a new market. It is a huge improvement of an existing technology. As famous example we can quote the iPhone from Apple that disrupted the market of the mobile phone, or the creation of numeric cameras to replace the camera using picture films etc.

The markets can be disrupted by two elements: the entrance of a disruptive technology or the creation of a breakthrough innovation.

6.2 Breakthrough Innovation and Disrupting Innovation

If the disruptive technology leads to the creation of a new market then we call it a "breakthrough innovation" (Merkapt 2011). In this case the market will be highly impacted and customers will have to face completely new concepts of products.

Clayton M. Christensen, teacher at the Harvard Business School and researcher at the MIT, was the first to introduce the notion of disrupting technology in his article « Disruptive technologies: catching the Wave » (*Harvard Business Review* 1995) and he went more in details in his book "The Innovator's Dilemma" (2000). He describes a disruptive innovation (or breakthrough innovations) as "a process by which a product or service takes root initially in simple applications at the bottom of a market and then relentlessly moves up market, eventually displacing established competitors".

6.3 Sustaining Innovations versus Disrupting Innovations

According to Christensen, those disrupting technologies are facing the sustaining technologies that group all technologies and innovations that are not creating new markets and only keep improving gradually the performances of the current technologies available on the market (Christensen, 1997; Christensen and Raynor, 2003.)

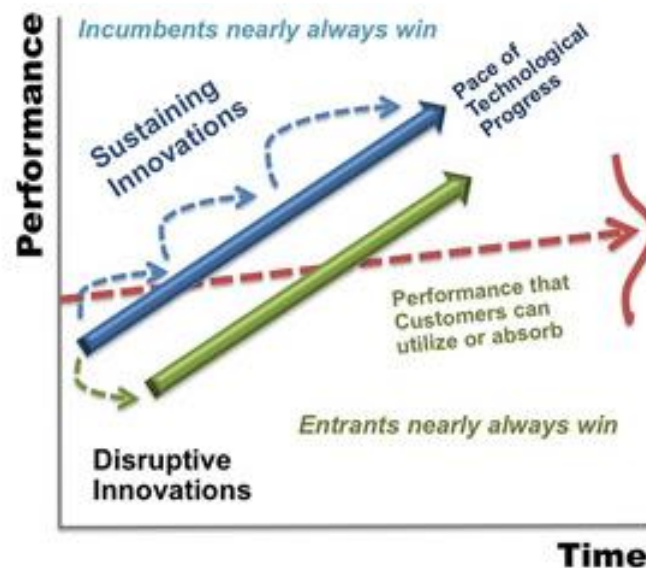


Figure 10. Graph representing the Disruptive Innovation Model

According to Christensen vision (2004) national companies such as big multinational corporations are more likely using the sustaining innovation. Indeed they already have products available and “just” need to improve it regularly to stay on the market.

In this situation a new company would not be able to compete with older and bigger companies because those last ones will always have the upper hand. There is always a potential more important for disrupting technologies to reverse a trend in the market. Then start-ups seem to be more inclined to create such a disruption through the launch of a very new product.

The aim of a disruptive technology or innovation is to highly impact the market. It targets a segment that is not grouping persons using the sustaining innovations but those who actually are non-customer of this technology.

The new product does not directly compete with the products available on the market.

Chapter 2

vcMETHODOLOGY

1.1 Research Objective

The goal through this research is to identify the reasons that push and allow IT start-ups to be able to launch a product that fits the customer better and to disrupt the market by doing so.

The theory is that they based themselves on the new management methodologies and new technologies of the web to achieve this.

- Identify the management tools used by IT start-ups and French IT companies.
- Figure out the level of use of Cloud Computing and Open Data systems in the creation process of a new product.
- Describe how start-ups manage to combine the above elements to launch a product.
- Identify the necessity of new technologies and communication to disrupt the market.

1.2 Problem Definition

All the elements at our disposal are from books and articles and are therefore not directly coming from the market. They are theories that we want to test and realize their real use in the labour field.

Our objective is to measure the real application of all the theories that have been discussed previously.

This research only is a first approach to the problem studied. The analysis of the data collected during the few interviews would provide a first inside look to validate the previously discussed theories and find out key elements to this study.

It would requires further analysis to be complete enough and so to enable us to generalize the theory to all the markets. The number of interviews should be increased in order to get more relevant information to be deeply studied.

1.3 Research Design

To find out those elements the author conducted a qualitative research through the use of interviews of several Finish and French companies and start-ups.

On the contrary of what was originally planned the author decided to interview people working in big companies and not only for start-up. The expecting goals were to see the possible implementation of the web 3.0 and the management methods in those companies. Also those interviews aim to understand the companies' relations to the start-ups' evolutions.

The plan developed through the questionnaire available on annexe IV is:

- a) Receive the definitions of the main terms to ensure that the bases are the same for the author and the interviewees (about Agile, Lean, Cloud, Open Data, market disruption etc.)
- b) For each point gathered information whether they are using the methodology or technology or not, and what are their reasons for it.
- c) Find out if they have more knowledge about the topic even if the methodologies and IT tools described in the Literature Review are not applied in their case.
- d) Finally, the answer to the research problem in order to highlight the link and the use of both new management methodologies and new technologies in products creation to perhaps disrupt a market.

The interview was directly based on the Literature Review's definitions order (management topics first, then the web-linked subjects etc.)

The goal is to understand to what extent the theory presented in the literature review is actually applied in business and what is its impact on the market.

The respondents that accepted to take some time to help this project are:

- An Information System Consultant at Capgemini France referred to as « French IT Engineer”. Capgemini has been created in 1967 in Grenoble, France. Since this time it has become one of the world's leading companies in consulting and IT services industry. Nowadays the company is present in 44 countries and employed more than 125 000 employees.

- A co-founder of the website founder2be.com referred to as "Finnish co-founder".

Created in 2011 the Finnish start-up offers an online service permitting to people to sign in to find professionals that want to create a business. It is a kind of professional network having for goal to match people according to the kind of person and knowledge they are looking for to start a business. The start-up is doing very well and is now participating to various events all over the world.

- A teacher-researcher at the CVO laboratory (Operational Cryptology and Virology), manager of the project « Open-Data Mayenne » in France. Below referred to as "French Manager". He is assisted by engineer students and around ten local companies from the Region Mayenne (referred to as "French students"). The project management method used for this project is the agile management. The aim of this work is to create a secured mobile application (available from all the platforms) to massively distribute the administrative, entertaining and politic data of the Mayenne Region. It is an Open-Data project.

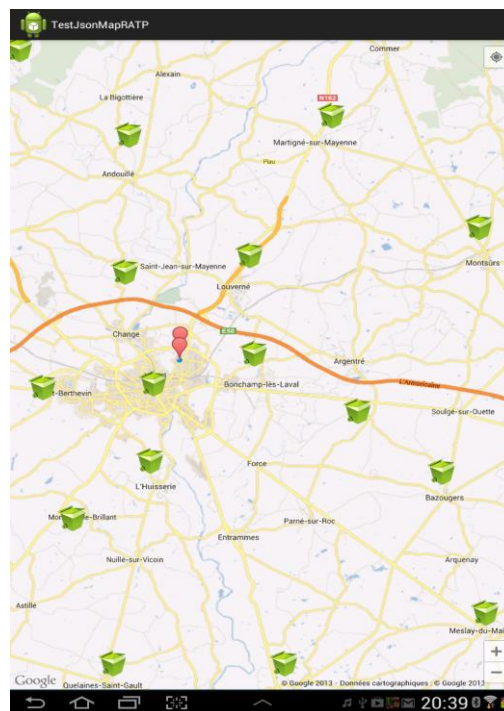


Figure 11. Screenshot of the application on Android, showing landfill sites

Chapter 3

RESULTS

In this part we will first present results that we may have been expected in terms of definitions around the notion of Web 3.0 that is, as mentioned in previous chapters to be the next evolution of the web, based on Cloud Computing and open data technologies.

In a second part we will have a closer look to what is the real situation about this evolution coming up. This part will be based on the result obtained from the interviews.

3.1 Presentation of the notion web 3.0 (theory)

New management methods lead to the improvement of computing tools (because of the needs of reactivity and share of data) and allow the evolution of the web from the current web 2.5 to the web 3.0 that is coming on.

3.1.1 Web 3.0 presentation

The transition from web 1.0 to web 2.0 has been a real change in the use of the web and in its functionalities. The web 3.0 is an "intelligent" web because it should understand requests made in normal language and not more simple key words.

The web 3.0 is often called "semantic web". It is defined by Nova Spivack one of the leading voices of this new-age Internet, (2007, *Web 3.0 Roundup: Radar Networks, Powerset, Metaweb and Others*), as a "set of standards that turns the web into one big database" and where the machines will "read web pages as much as humans read them"

The main particularity of this new version of the web is going to be an easier access to the available resources. The goal of this new evolution is to transform the web as we know it today into a worldwide database based on the principle of the Cloud Computing. By doing a research in any browser the user will find results that highly correspond to what he is looking for, while for now the websites that appear on the top of our list of results always are the most seen websites linked to the keyword we typed in. Web 3.0 will be design to

understand natural language. The web 3.0 is purposely design to connect the knowledge through a tagging system of the data (we call this process "folksonomy") (see diagram below) and to be user-oriented through an understanding of the research and the use of the data.

A diagram representing the operation of the web 3.0 is available at the end of this thesis, annexe n°5.

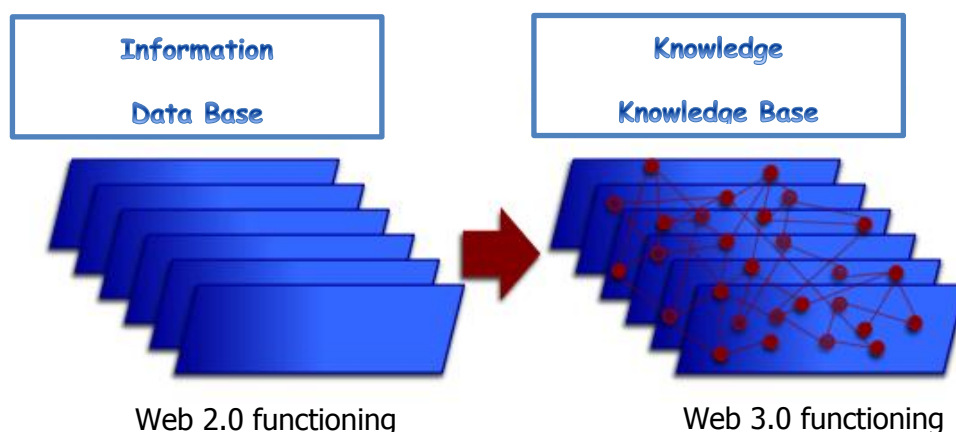


Figure 12. Semantic graph explanation

This new version of the web is going to use a maximum of data from the customer and also of the companies through the Open Data services. This semantic web is going to allow the machine to resound about the relevance of the content and not on lexical statistic any more (Zurstrassen, 2009: 4).

It seems that this future web will be particularly efficient in research domains of business, travels, real-states (like Trulia in the US) and employment (2008, Comment Ca Marche, *Everything about web 2.0*).

The web aims to find out our own interests through the analysis of the previous requests made. By compiling that information it would then be able to send alerts about topics that you are logically supposed to be interested in.

3.1.2 Development of technologies linked with the web 3.0

Technically speaking the main change that is made from web 2.0 to web 3.0 is the restructuration of the websites. Those used to be created based on some basic web structures and languages (PHP, HTML, CSS etc.). Those websites are now more and more being converted with object based languages such as Java, Java Script, .net, RDF (Resource Description Framework) etc. that make easier the querying of Web data regardless of their format. This evolution is the basis of

the new way of programming and pushes the creation of other new languages for the web 3.0.

The Internet of Things is the third component of web 3.0 after the Classical Internet (normal connection from a computer) and the Mobile Internet (on smartphones).

This new web is defined as an omnipresent web that will be connecting computers, phones, alarms clocks, television, fridges and any others electronic devices. Some researchers also linked this new web with the notion of "real-time" (Peres, 2008) and to the "3D web" that will turn to be more attractive and closer to the real world. This future web is source of many opportunities for companies because it will allow them to develop adapted applications and software. The 3D tends to be more and more developed because it may be used not only for video games but also may helped to develop new working environments (remote meeting via web conferencing, virtual classroom training), new e-commerce (virtual shopping malls) etc. (Boquet-Cochard, Collé, Dornès, Hardel & Joao, 2011).

The new Google glasses available in the US are a good example of an object of the Internet of Things because it is linked to the web, and allow the user to have an access to his personal data, to take pictures etc. (Lunettes Google, 2013)

The changes in the languages that are used to code and create new applications are evolving to better interlinked the data and solve problems of interoperability between the services available online and the application users are making of it.

This is for example the case of the SpotCode that is developed to make the physical environment "clickable" (Bizncach, 2004). This technology uses the system of bar code placed on any object and that can be read by a mobile equipped with image recognition software.

3.2 Presentation of the notions obtained in the interviews

These interviews shown that big French companies mainly are not involved in the development of Cloud and Open Data. They let start-ups doing this risky jobs and focus on finding out new elements (like languages) in order to get prepared to the moment the technologies of Cloud, Open Data and the overall web 3.0 will be better known, more accessible, less expensive etc.

Indeed companies increasingly observe that technological revolutions are coming and growing fast. However for the moment they are suspicious and have made the choice to prepare themselves effectively. On the other hand, the economic situation in recent years does not encourage companies to invest in such technologies or infrastructures that are highly expensive.

“Actually, we see Cloud Computing as a promise of good and large future in our development but it is still not mature enough to be invested in” French Employee.

Therefore, what we see today is that companies develop two things: the web development tools (frameworks) and specific programming languages.

3.2.1 Web development tools: Frameworks

Nowadays, web projects developments are becoming heavy in terms of money and then time, they are not competitive anymore. This is why companies invest in development and the creation of frameworks. These will help to save time and to facilitate teams to develop a product.

A Framework is defined by the MacMillan Dictionary as “a structure that supports something and makes it a particular shape”. In the IT domain this structure will be composed of software that organized and combined will create the skeleton of a program on which the programmer will be able to create what he wants. A framework is like a template: it is pre-programmed.

A framework is designed to help programmers in their work:

“It helps companies like Capgemini to provide quick solutions to put in place for the customers”. Capgemini, French Employee

3.2.2 Creation of new web languages

Companies are creating a lot of specific and distinct languages to prepare development teams to create new services or applications to Web 3.0. This preparation is due to the interoperability for the transparent exchange of information between different terminals, websites or databases that will be increased with the web 3.0.

Some examples of languages that are developed are:

- **The RDF** that allows data merging far more easily than it is today.
- **The OWL** (Web Ontology Language) is a logic language that improves the RDF by linked data and making implicit knowledge explicit. It is more accurate than the RDF.
- **The SPARQL** (*Simple Protocol And RDF Query Language*) technology, recommended by the W3C, facilitates querying Web data regardless of its format (W3C, 2008).

A huge number of languages exist. Those on the schema below are currently used by programmers. Many others are getting created to answer the new needs to inter-link the data (basis of the web 3.0).



Figure 13. Programming languages list on the web

Some of them are used to adapt the code of an application to certain devices. It is for example the case of Java and XML for Android or of the C # for the iPhones.

"Re-translate or create applications for these new devices is require to ensure they are in the "Language of Object" and that everyone, no matter of the device used, can have an access to it"

3.2.3 Open Data project management and development

On the project developed by the French Manager and his students, the goal is through many partnerships, to share a huge amount of information in order to create new companies into the Region whom manage and diffuse those data. The different aspects that needed to be developed in an Open Data project like this one are:

- The Network: This element is the basis to correctly transport the data from the servers to the platforms where it becomes accessible.
 - The Security: Manage the issues linked to the access of the information (some of them may require a higher level of protection so that their access is not open to everyone even if it is available on the Open Data system).
 - The Mobility: The team needs to encode the applications so that they can be available and functional on all the platforms.
 - The Aestheticism: It is primordial to ensure that the application that allows the access to the open-data is easy to use and attractive.
 - The Management: Mass information also called « Big Data" needs to be stocked and classified so that the previous pole above can correctly use it to build the application.
- ➔ "This is a decisive contribution to the bubbling of digital innovation in the region, the soil that will create new value and employment." French Manager.

All interviews shown that the Cloud Computing is actually slightly used to conduct projects and help the sharing of information. The rate of use depends on every project but what came up from the interviews is that the Cloud does not represent the central element of a project nor is the principal way to exchange information. In 100% of the case the interviewees were not managing nor often using the Cloud services. In the "Open-Data Mayenne" project the Cloud service is managed and provided by another company, member of the project.

In other projects cloud and open data are not used the same way.

- "All those terms are just buzz words. I don't know how to define them really, and I think there is a lot of different definition you can find on the internet".
Finish co-founder.

3.2.4 Project Management Methods

In the development of the Open Data System, the project management method used is the agile one:

- "Our objective is to build a basis Open Data System which will be only improved from the customers' feedback like Mayenne Region and the population whom live in. Communication will be the soil of this project."
French Manager.

Specifications have been given to the teams and the members of the project but the final product was not clearly and precisely defined. This situation was expected and has been set up in order to get more ideas from the development teams all along the project development.

- "Companies and managers often are asking us about our advancement in our tasks. They are very open-minded and push us not to be shy and to share ideas and problems with them and the others". Engineer student.

If one team has a new idea or changes to present in order to improve the system then it can more or less influence the other team's work. This is why agile is highly necessarily here to ensure a good communication, have an updated feedback and share new ideas. They naturally included the feedback loop through various ways of communication and mainly weekly meetings so that all participants know where the progress of the project is, and to submit new ideas that can be included.

In all cases, the respondents answered that the choice of using agile methodologies often came from a common sense more than from a competitive mind or to the wish to implement it because they have been taught (in university or other) to do it this way.

- "In my case and because it is the policy of the company, agile methodologies mainly are used in small projects that allows it. Bigger projects, because

there are more important are based on the waterfall or other old methodologies” French IT Engineer.

- “I never studied management. To me it was simply the logical way of functioning according to the service we provide”. Finnish co-founder.

The difference between the agile methodologies, lean management and lean start-ups is not known from the interviewees. The responds about this topic were very similar and vague: agile are applied to big companies and that lean start-up and lean management are mostly applied to start-ups.

Chapter 4

ANALYSIS

This part will focus on the analysis of the results the author received thanks to the few interviews done with French and Finish companies and start-ups.

The overall result it is possible to draw is that the entrance in the web 3.0 is not yet ready. Lot of work needs to be done by companies to be prepared to this change. They need to adapt their infrastructures. To do so they need many resources and this is why the advent of the web 3.0 is quick slow. As soon as the democratization of the resources will have happened then companies will be able to adapt and to launch the web 3.0's era.

4.1 About the project management methods

It first seems to be that for these interviewees agile methodologies are required to be used and implemented, especially when it comes to relatively small projects.

The French IT Engineer explained that bigger projects that run for months are based on the V-model or the Waterfall one. He mentioned that the reason for it is that those predictive methods are easier to implement and that the customer may not need to see the project development every week. The work is spread at the beginning thanks to a Gantt diagram (project management tool) for the whole team; deadlines are fixed; everyone starts doing its part reporting to the management by e-mails and meetings every week or two weeks.

From the start-ups point of view the results were that agile methods actually came from common sense. One of them explained that teams' meetings are taking place every week or two weeks. This allows to discuss the new possibilities (brainstorming), to find out the problems that occurred, to improve the overall service, to set new objectives for the coming week(s), to analyse the feedback etc. Without having studied project management methods, or having read about lean start-ups they spontaneously set-up this method that is actually the agile one.

In the French project of the Mayenne Region, Agile methodologies have been naturally put in place because the customers wanted the students to participate actively, to share their opinion and ideas so that they really are involve in the development of the Open Data system. Furthermore because they are still studying they may have more knowledge than the customers on the new trends, and possibilities in terms of use of new technologies.

4.2 About the web evolutions: open data and Cloud Computing

From all the interviews done results were that open data and Cloud Computing mainly are seen as "buzz words". This means that they consider those technologies as blurred one and all interviewees underlined the fact that there are many different definitions that can be associated to those terms.

In none of the interviewees' company the need of those technologies is real. Plus they all mentioned the cost it would be to use them efficiently nowadays (around few hundred of million dollars).

The Cloud represents a new opportunity of virtualizing the data. This service is accessible to anyone but is not that spread in the business world. The Cloud is used sometimes to times but more in a personal level than in a real professional one. Some employees are using their own DropBox account instead of creating one for the start-up or the company. Developing new services and products on the Cloud is not easy because it requires the company to possess the good infrastructure. This one is expensive

The interviewee of Capgemini admitted that the company is sometimes using the Cloud but only "to follow the trend". The reason is indeed that the company does not need it yet and wait to see how it will be developed and better integrated in the business world before to focus on it.

4.3 New elements brought thanks to the interviews

Doing those interviews have raised a concept the author had not think of at the beginning of the researches. They all mentioned the fact that companies are more careful and let start-ups and entrepreneurs take the risk to launch something new. If this new product or technology is well received by the markets then companies will try to buy the start-up to acquire the product. Once they

know markets are interested in this product they would be more incline to put millions of dollars or euros to improve and develop it.

According to the responses of several interviewees it seems that in the US big companies are ready to buy a start-up that managed to create a disruptive innovation for the price of \$20 million. According to this same person entrepreneurs know that if they do something very different and innovative they may catch the attention of bigger companies and be bought for few million. This is something not everyone will refuse! DropBox (as presented in page 24) is the best known example of a start-up that refuses to be bought by Apple. The company is now worth three to four billion dollars.

4.4 Final key elements gained from these interviews

The overall analysis of these interviews is that the evolution of the web (because it is more and more used it presents more and more needs in terms of services to be associated or created with and for) allows the creation of more start-ups. Because their number is higher there is more chance to have one of them succeeding in developing or a disruptive product or creating a new market.

Start-ups are not disrupting a market because they are using agile methods and are the new technologies. These tools help to increase the number of start-ups creation every day. It is because there are a lot of people trying to find a new product that one of them will sooner or later find something valuable to be developed.

Furthermore, start-ups generally manage to find a product that will lead a market creation and not only to a market disruption. This means that they managed to create a completely new product to answer a need that had no product to respond to it before.

The web is growing up every day and they are always new needs to be fulfilled and new evolutions to be created to expand it. This is the reason why there are more and more start-ups that based their products on this technology: the resources and the possibilities seem to be infinite. There will always be something to be improved or adapted.

4.5 New issues raised during the interviews

Finally it is important to mention two questions the author has mentioned during the interviews. Those concern the future development of web and how we will be able to handle all these visions we want to create a proper and secure way.

The first point is to focus on the security aspect of the data. This especially occurs when talking about Open Data. This system indeed brings us into a situation where we want to share more but also to protect more. With hackers development all over the world, we are now facing cyber-wars and warfare situations. The question linked to this problem is to find out how to manage the level of security depending on the level of importance of each data.

The second idea people shared during the interviews is about the management of data. The problem that companies and governments are facing is to find a way to stock, virtualize and disclose information in good conditions. This means not to saturate the network with too much information, to have the ability to be able to digitalize and compress or reduce to size of the data.

Those aspects are linked to the Open Data and the Web 3.0 development through the will to make public information in order to create new functionalities that will improve the overall wellness of the population.

Conclusion

Companies are now observing that these IT technologic revolutions promise high perspectives in future services, development of new products and new product management methods.

However, large European companies (on the contrary to the US') are conservatives and prefer to wait for these technologic revolutions to mature and to get democratized (so that they become less expensive, easiest to access and better adapted in terms of infrastructures).

Those revolutions are presenting new opportunities and a huge potential to be exploited by start-ups. This amount of possibilities leads us to a period where there are more and more creations of start-ups based on the design of a product or a service linked to the web. This popularization will help larger companies in the sense where they will keep using safety methods while they will let start-ups take the risk to go on projects in completely new domains. Once they have grown and have reached a significant market share start-ups may help IT companies to develop new products by being purchased and work for them instead of keeping their independence.

This process will go through small projects and services mainly linked to open data and Cloud Computing. Currently the highest challenge for companies and start-ups is to find the technologic way and the appropriate services to work on and treat Big Data (group of data that became so large that it is difficult to work on it by using traditional database management tools (Gartner, 2012)). If they find solutions in this sense then it will allow some technologies to be created (like the web 3D).

The situation is quite similar for the management. We observe thanks to the interviews and the current trends that there is a confrontation between agile and the predictive methodologies. This means that larger projects are mainly managed with predictive methods because those ones are better known and controlled. On the contrary agile methods are promising but still in an experimental phase which implies that they are implemented in smaller projects.

All those methods and working trends represent opportunities for research that according to the interviews seem to be the domain chosen by entrepreneurs who want to create their start-up and reach success.

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